On Relationships Among the Australasian Microtektites, Toba Mega-Eruption and Geomagnetic Reversal: An Impact Trilogy?

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During the IMAGES III Cruise in 1997, several giant piston cores were retrieved along the western Pacific marginal seas. Among them, two cores, MD972142 and MD972143, penetrated the Brunhes/ Matuyama (B/M) boundary and therefore were selected to examine the hypothesis that large comet/asteroid impacts may trigger geomagnetic reversals. Between the stratigraphic intervals of the Australasian microtektites and the B/M reversal, a disseminated tephra zone of the Oldest Toba Tuff was found from Core MD972142 (119.56oE, 12.69oN) in the South China Sea. Based on strontium isotope, major chemical composition, and oxygen isotopic stratigraphy, these glass shards were identified to be the Oldest Toba Tuff at 788ka. This new occurrence extends the distribution of Toba tephra some 2500 km east of the previously known fallout zone. Recently, eastern dispersal of the Youngest Toba Tuff at 71ka was also reported from the deep-sea cores in the South China Sea. Such results could have facilitated modeling the dispersal of Toba tephra and assessing the atmosphere impact of the mega-eruption.

Tektites are natural glasses formed by melting of upper crustal materials during the hypervelocity impact of an extraterrestrial object. So far, there is no unambiguous identified source crater for the Australasian tektite strewnfield. Based on the spatial variations of the microtektite thickness in deep-sea cores, the diameter of the source crater was estimated to be about 100 km and the location of impact crater at about 12oN, 106oE (in Cambodia). If so, the distance between the Australasian impact site and the Toba volcano is only 12.6 times the diameter of the impact crater. In viewing the geographic and temporal proximity, we speculate that a large-body oblique impact might change the stress accumulation within the crust and trigger an active volcanism.